

इंटरनेट

मानक

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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 9053 (1978): Code of safety for m-dinitrobenzene [CHD 8: Occupational Safety, Health and Chemical Hazards]



“ज्ञान से एक नये भारत का निर्माण”

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“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS : 9053 - 1978

(Reaffirmed 2009)

Indian Standard

**CODE OF SAFETY FOR
m-DINITROBENZENE**

UDC 661.717 : 547.546 : 614.8



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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

AMENDMENT NO. 1 DECEMBER 2006
TO
IS 9053 : 1978 CODE OF SAFETY FOR
***m*-DINITROBENZENE**

(Page 4, clause 3) — Insert the following new clause at the beginning and renumber the subsequent clause:

'3.1 General Information

- | | |
|----------------------|--------------------|
| a) Molecular formula | : $C_6H_4(NO_2)_2$ |
| b) Molecular weight | : 168.11 |
| c) CAS No. | : 25154-54-5 |
| d) UN No. | : 1597' |

[Page 4, clause 3.1(d)] — Insert the words 'closed cup' *after* 'Flash point'.

(Page 5, clause 4.1.5) — Substitute the following for the existing text:

'Threshold limit value of *m*-dinitrobenzene, TLV-TWA is 0.15 ppm'

Indian Standard

CODE OF SAFETY FOR *m*-DINITROBENZENE

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Indian Standard

CODE OF SAFETY FOR *m*-DINITROBENZENE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 December 1978, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

0.2 Of the three isomers, *m*-dinitrobenzene (DNB) is of practical importance as an intermediate in dye industry and in the explosive industry, being a constituent of explosive roburite. The second nitrogroup is directed chiefly into the meta position although 7 to 8 percent of ortho and para isomers are formed.

0.3 In the preparation of this standard, assistance has been derived from the following publication:

SAX (N. Irving). Dangerous properties of industrial materials
1975. Ed 4. Van Nostrand Reinhold Co, New York (USA).

1. SCOPE

1.1 This standard describes the properties of *m*-dinitrobenzene, nature of hazards associated with it, preventive measures for controlling the hazards and essential information on storage, handling, packing, labelling, employee education, personal protective equipment and first-aid.

1.2 This code does not deal with specifications for design of buildings, process equipment, storage vessels, etc.

2. TERMINOLOGY

2.1 For the purpose of this standard, the following definition in addition to those given in IS : 4155-1966* and IS : 4167-1964† shall apply.

2.1.1 *Excursion Factor* — Period for which exposure to a concentration exceeding its threshold limit value (TLV) is permissible.

*Glossary of terras relating to chemical and radiation hazards and hazardous chemicals.

†Glossary of terms relating to air pollution.

3. PROPERTIES OF *m*-DINITROBENZENE

3.1 Important properties of *m*-dinitrobenzene are as follows:

a) Colour	Yellow crystals
b) Melting point	89 to 90°C
c) Boiling point	300 to 303°C steam volatile
d) Flash point	150°C
e) Solubility	1 g soluble in 2 000 ml of cold water or 320 ml of boiling water or 27 ml of ethyl alcohol or 20 ml of boiling ethyl alcohol. Freely soluble in benzene, chloroform and ethyl acetate.

4. NATURE OF HAZARDS ASSOCIATED WITH *m*-DINITROBENZENE

4.1 Health Hazards

4.1.0 General — Poisoning may be caused by inhaling the vapours or by absorption through the skin. Contact of solution particularly with skin should be avoided. It has irritating effect on the respiratory system and causes skin to become bluish in colour. Although *m*-dinitrobenzene has relatively little volatility, a concentration as low as 1 mg/m³ may be sufficient to cause acute poisoning. Therefore, great care should be taken to avoid toxic concentrations. *m*-Dinitrobenzene is a strong poison affecting blood and liver. It causes formation of methaemoglobin which can be seen in the intense blue discoloration.

4.1.0.1 Lethal dose (oral) — Lowest published lethal dose (cat) is 27 mg/kg. Ld₅₀ (wild bird species) is 42 mg/kg.

4.1.1 Acute Toxicity — Since *m*-dinitrobenzene is a solid, cases of poisoning develop less rapidly and are less severe than in the case of nitrobenzene. Poisoning occurs among men who shovel or melt *m*-dinitrobenzene. An attack usually develops some hours after a man has left the plant and rarely during work. The main effect of *m*-dinitrobenzene is the conversion of haemoglobin to methaemoglobin. This may progress to the extent of making the colour of blood chocolate. The red cells are reduced in number and show marked punctate basophilia. The haemoglobin, therefore, proportionately decreases. The total number of white cells increases, but with a relative decrease in the polymorphonuclear cells, *m*-dinitrobenzene in the body undergoes change into *m*-nitroaniline, and is eliminated in this form in urine. A workman may notice that he passes smoky urine soon after first contact with *m*-dinitrobenzene. It has been observed that poisoning occurs more often on hot days than on cooler ones owing to the

high vapour pressure of the compound at higher temperatures. Women are more sensitive to *m*-dinitrobenzene than men. Poisoning by *m*-dinitrobenzene results in increased sensitivity and hence makes the sufferer more liable to repeated poisoning, especially in less resistant persons.

4.1.2 Chronic Toxicity — Chronic industrial poisoning is possible in two ways. In the first it causes degeneration of haemoglobin and recovery follows within 1 to 2 weeks. In the second form appearance of delayed symptoms takes place from 1 to 3 months of exposure. Within 1 to 3 weeks after the first symptoms are manifested, degeneration of the liver takes place. Women are particularly liable to this form of poisoning.

4.1.3 Fate of *m*-Dinitrobenzene in the Body — Part of it is excreted unchanged through the urine and the remainder undergoes further changes in the body.

4.1.4 Symptoms of Exposure to *m*-Dinitrobenzene — General weakness, emaciation, intestinal disturbances, more or less marked enlargement of liver and spleen and dirty coloration of the skin are common symptoms. In cases of more severe exposure cyanosis, dyspnoea, vertigo, flickering before the eyes and blurred vision, sensory disturbances, especially of the lower extremities and dark colour of the blood are the symptoms.

4.1.4.1 In case of moderate exposure for 2 to 4 weeks, symptoms are anaemia of different intensity, moderate cyanosis, fatigue, slight vertigo, headache, insomnia, changes of eating habits and loss of weight. Prompt recovery after discontinuation of exposure takes place.

4.1.4.2 In more severe cases, subjective complaints are headache, flickering before the eyes, vertigo which sometimes results in staggering, fatigue, nausea and vomiting, dyspnoea, oppression and pain in the chest, complaints about taste and odour of bitter almonds, burning in the mouth and pharynx, dryness in the throat and thirst. Objective findings are marked cyanosis, mostly on the face. Variation in the colour of the skin from pale yellow, light grey, blue black and dark brown are mainly noticeable on the lips, ears, nose, breasts and the mucous membranes of the eyes and mouth. Loss of appetite, gastric pressure and pain, constipation and diarrhoea are occasionally observed. Urinary findings vary with the clinical condition of the patient.

4.1.5 Threshold Limit Value (TLV) — Recommended threshold limit value as accepted by American Conference of Government Industrial Hygienists, for *m*-dinitrobenzene for continuous exposure for 8-hour work-day and 40-hour week is 1 mg/m^3 in air. Excursion factor allowed for a period not exceeding 15 minutes is 3 mg/m^3 .

4.2 Explosion Hazard — Owing to its deficiency in oxygen, its explosive properties are not marked and detonation is difficult to bring about. When mixed with potassium perchlorate it forms 'Cheddite', with ammonium nitrate roborite and with gun cotton a smokeless powder called 'Indurite'.

5. STORAGE AND HANDLING

5.1 Storage — *m*-dinitrobenzene is stored in mild steel containers, preferably drums. Storage areas should be well ventilated. The containers should be plainly labelled.

5.2 Handling — *m*-dinitrobenzene being in the solid state, men may be required to shovel for transferring the product. While doing so, it shall be ensured that the crystals do not stick to the body and clothing or else *m*-dinitrobenzene may be absorbed from the evaporation of crystals adhering to the clothing. If containers are being emptied by steam heating special attention shall be paid to the removal of steam containing the toxic substance. Spillage of the product shall not be tolerated.

6. PACKING AND LABELLING

6.1 Packing — *m*-dinitrobenzene shall be packed first in double polythene bags and then in suitable mild steel drums. It shall be ensured that the outer side of the container does not have even traces of the product sticking to the surface.

6.2 Labelling — The following information shall be incorporated and used in combination with other instructions on the labels:

META DINITROBENZENE. AVOID CONTACT WITH SKIN. VAPOURS ARE TOXIC. DO NOT USE EMPTY CONTAINER FOR ANY OTHER PURPOSE. EMPTY CONTAINERS ARE TO BE WASHED AND INACTIVATED WITH ALKALI WASH OR STEAMING BEFORE BEING DISCARDED.

NOTE — Where inactivation is done with alkali, no heating should be done.

6.2.1 Each container shall bear the label 'POISON'.

7. PREVENTIVE MEASURES

7.0 General — This includes selection of personnel, medical supervision, safety measures, factory buildings, good housekeeping, personal hygiene and training.

7.1 Selection of Personnel — In respect of selection of personnel, juvenile and female workers and also weak persons in poor nutritional state appear to be more susceptible. Persons suffering from circulatory disturbances, infection of liver and kidneys (of the blood and blood forming organs)

and of the skin appear to be especially susceptible and it should be emphasized that susceptibility to *m*-dinitrobenzene poisoning increases with further exposure. Workers handling *m*-dinitrobenzene should be periodically examined. Special attention should be paid to the behaviour of blood and urine, *m*-dinitrobenzene with alcohol produces synergistic effect, hence drinkers should not be employed in *m*-dinitrobenzene processes.

7.2 Medical Supervision — An effective health programme to prevent cyanosis due to exposure requires adequate medical supervision measures. Routine bimonthly examination for each worker should include past history, medical observation, blood pressure, pulse, weight, blood and urine analysis. Additional blood and urine specimens are collected whenever unusually hazardous conditions or known exposures have been encountered. Periodical blood and urine examination shall include RBC, the presence of poikilocytosis and anisocytosis, stipulated and basophilic cells and juvenile forms. Urine shall be checked for albumin, blood pigments, bile pigments and presence of aminophenol. Normal haemoglobin content of 14.5 ± 0.5 g/100 ml is considered good. If it goes down to 13 g/100 ml careful observation is necessary. Haemoglobin less than 12 g/100 ml requires change of work place and total elimination of exposure to *m*-dinitrobenzene.

7.3 Safety Measures — The necessary protective measures in ascending order of effectiveness are respiratory protection, job rotation, limitation of exposure time, use of protective clothing and whole body protection. Respiratory protection has limited application as skin absorption is the major problem. Rotation of individuals within a work crew, constant medical attention to determine who is to be relieved, limited exposure duration require large reserve man power. Use of butyl rubber protective clothing, gloves, aprons, etc, can reduce exposure to within tolerable limits. Complete body protection for severe exposure conditions can be provided by either an unventilated chemical hazard suit (acid suit) or air suit.

7.4 Process Building — In building a factory which is to be perfect from both technical and hygiene point of view it is important that doors, windows, wall partitions and platforms should have adequate ventilation. Special attention should be paid to the removal of steams containing the toxic substance from the work place. A high standard of plant cleanliness should be maintained. Floor washes shall be provided to tackle spillages. Water stagnation within the work place should be avoided. Drains around the building should be in perfect order. Adequate ventilation in the working place should be provided.

7.5 Housekeeping — There should be a constant campaign against careless and dirty habits. The floor of workroom should be smooth and

impervious to water. Floor should be washed daily with water hosepipe and drain water should be led into a sewer. A metallic receptacle with tight fitting cover should be used for depositing waste like rags, paper or other materials soiled with *m*-dinitrobenzene. The waste should be destroyed by burning at least once a week.

7.6 Personal Hygiene — A high standard of personal hygiene is essential while working with *m*-dinitrobenzene. Working garments, gloves, aprons, boots, goggles should be changed and cleaned every day or as soon as soiled. Stress should be on urgent necessity for changing at once and taking bath when the dresses are soiled. A warm shower with soap at the end of the shift should be compulsorily taken every day. Hair should also be protected from dust. It is desirable to keep the hair cut low. Do not eat, chew, drink or smoke in work place or with soiled hands. Wash hands, feet and face well, before taking meal. Keep food and drink away from work place.

7.6.1 Absorption from the alimentary canal is more rapid if the stomach is empty. It is, therefore, desirable that workers should have a meal before they begin their work. A good nutritional status is also important for the prevention of poisoning. It should be pointed out that for prophylactic purposes a mild cathartic and diuretic may be of advantage.

7.6.2 Complete abstention from alcohol should be practised while working with *m*-dinitrobenzene. Taking alcohol in ordinary amounts even during week ends is very dangerous.

7.7 Training — Persons engaged in work involving processing and handling of *m*-dinitrobenzene should be instructed in the operation of the process plant as well as safety measures for handling of *m*-dinitrobenzene with emphasis on avoiding leakage of and exposure to the product.

8. MEDICAL MANAGEMENT AND FIRST-AID

8.1 General

8.1.1 Health Examination at the Time of Employment — As a worker handling *m*-dinitrobenzene, it is unsuitable to employ an anaemic person with heart and kidney trouble, a person suffering from any urinary disease, a person prone to allergy and a heavy drinker. It is necessary to carry out a blood test and employ only a normal healthy person.

8.1.2 Regular Health Examination

8.1.2.1 Regular health examination should be carried out at intervals of not more than three months.

8.1.2.2 Blood tests should be done every month. It is necessary to check the condition of workers who may be exposed to *m*-dinitrobenzene from time to time and confirm that no case of anaemia is found.

8.1.2.3 By conducting urine tests (urobilinogen, propyrim, occult-blood test, and deposit), acute and chronic poisoning by *m*-dinitrobenzene may be detected for necessary treatment. It is desirable to carry out the examination of urine once in two weeks, especially once a week in summer.

8.2 Suggestions to Physicians

8.2.1 If possible, while the patient is acutely ill, methaemoglobin concentration of blood should be determined quantitatively at least every half an hour. Such check should be continued until it is established definitely that the concentration of methaemoglobin is steadily decreasing.

8.2.2 If the concentration of methaemoglobin reaches 40 percent in venous blood samples, 1 000 ml of 5 percent glucose may be administered intravenously and repeated in an hour, if necessary. This appears to stimulate the reversion of methaemoglobin to hemoglobin.

8.2.3 The patient should be comfortable in an oxygen tent. Oxygen serves to relieve headache transiently, apparently due to supersaturation of the hemoglobin and plasma with oxygen, but does not seem to hasten the reversion of methaemoglobin to hemoglobin. Under such treatment, the acutely toxic patients with methaemoglobin concentrations as high as 76 percent in venous blood samples usually make eventful recoveries within 24 hours, with no demonstrable permanent, residual pathology.

8.2.4 It is imperative that patients be closely observed and made to remain in bed for 24 hours if methaemoglobin content has reached 40 percent.

8.2.5 An intravenous injection of 10 to 20 ml of 2 percent ammonium thiosulphate and a large dose of vitamin C at one time contributes to quick recovery.

8.3 First-Aid

8.3.1 General

8.3.1.1 Take off the contaminated clothes at once and wash the skin immediately and thoroughly with plenty of soap and tepid water. Speed in removing *m*-dinitrobenzene from the skin is of prime importance.

8.3.1.2 Do not put on contaminated clothes again unless they are cleaned sufficiently.

8.3.1.3 Carry a toxic patient on a stretcher to the medical department or first-aid station.

8.3.1.4 No matter how slight his symptoms are, refrain from speaking loudly or doing anything which may disturb the patient.

8.3.1.5 Do not give a patient any such stimulant which contains alcohol. Do not use any tincture (containing alcohol) as a cardiac.

8.3.1.6 If a patient has consciousness, he may drink fluids containing carbohydrates, such as orange juice and sweetened lemonade.

8.3.1.7 Even though severe headache is complained of, drugs such as acetanilide, acetophenetidine and other methaemoglobin producers should not be given. Headache may be relieved by codeine administered by nursing personnel.

8.3.2 *Contact with Skin* — Remove all contaminated clothing. Get under an emergency shower. Wash the affected areas thoroughly with soap and tepid water.

8.3.3 *Contact with Eyes* — Wash the eyes with a large amount of water, holding apart the eyelids, for at least 15 minutes. Though *m*-dinitrobenzene does not give too much irritation to the eyes, it is apt to injure the cornea. A competent physician should be consulted as early as possible.

8.3.4 *Ingestion* — Ingestion of *m*-dinitrobenzene should be treated by the administration of an emetic such as mustard and water or a lukewarm emulsion of soap and water, provided the patient is conscious.

CAUTION — NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

8.3.5 *Inhalation* — Inhalation of the vapour requires the same treatment as that for skin absorption or ingestion except that an emetic is needed only when *m*-dinitrobenzene is swallowed.

(Continued from page 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	Siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²